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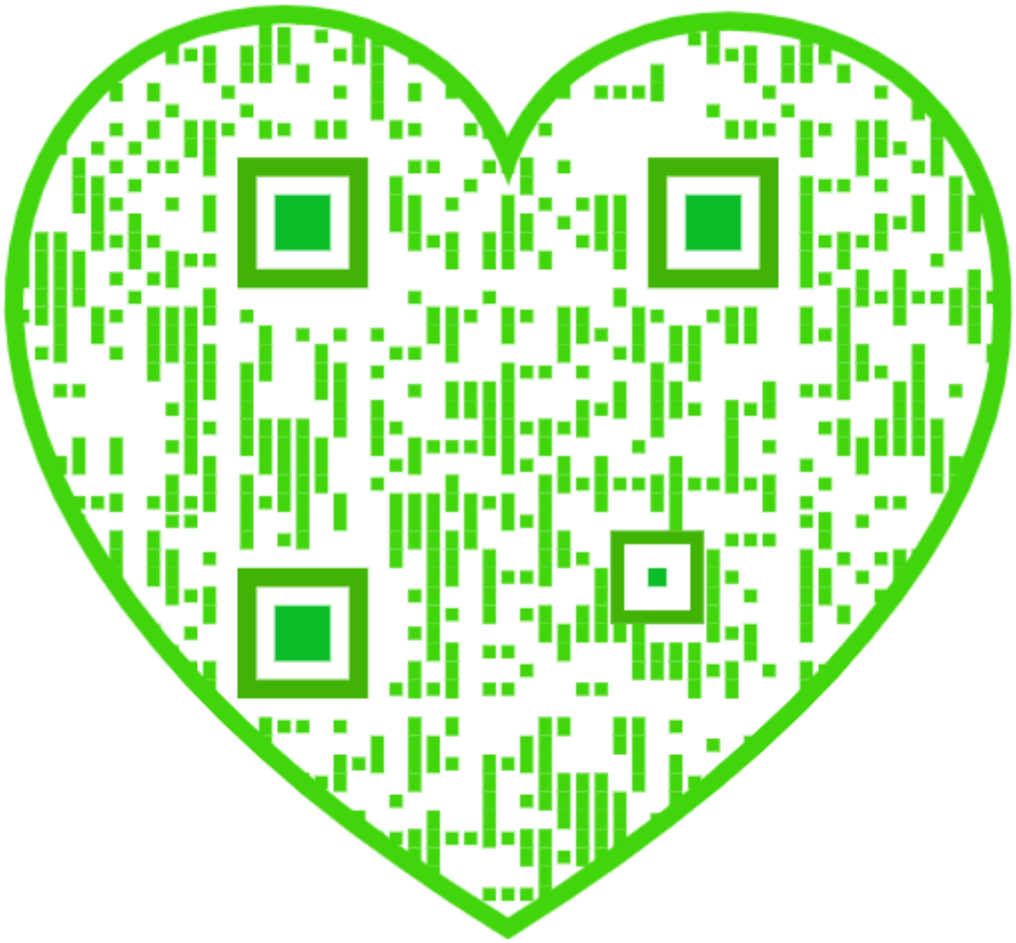
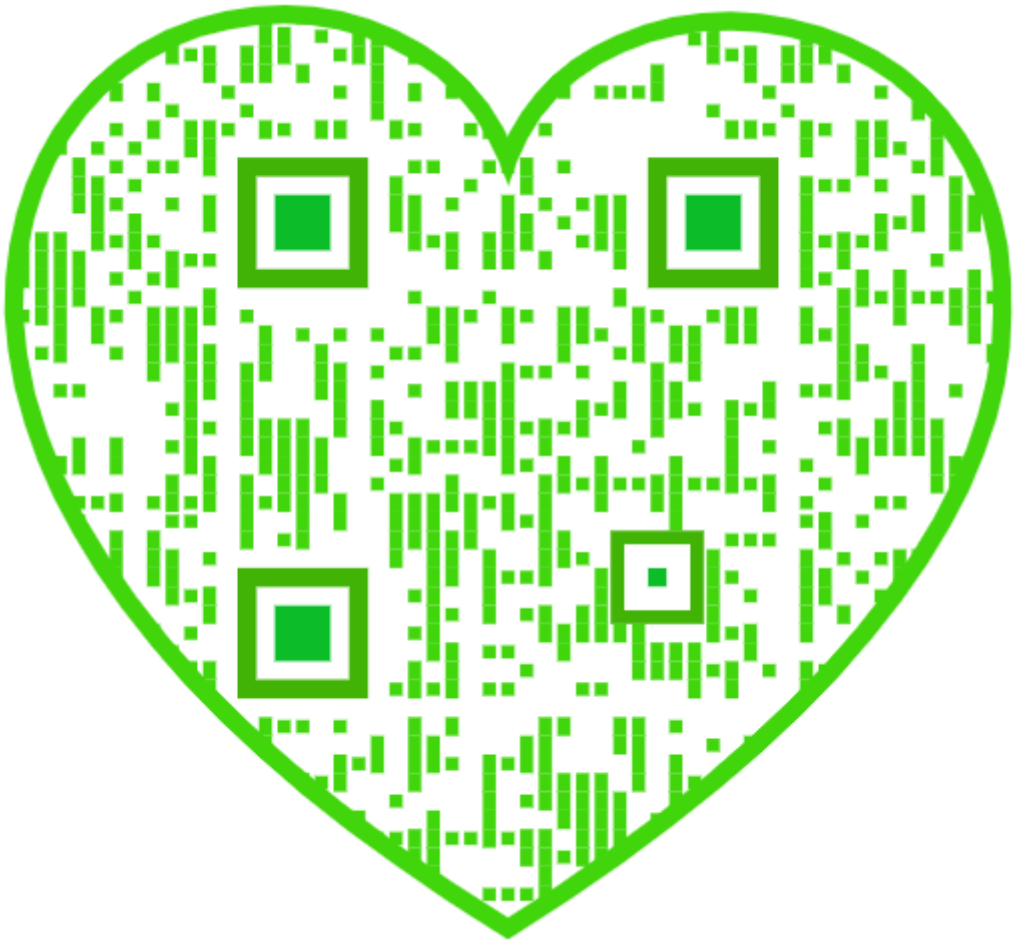
School Sanitation





SCHOOL SANITATION

AS the name indicates, this book deals entirely with the broad and important question of how to have a thoroughly sanitary school.

"School Sanitation" was written and designed so as to be readily understood by all who read it and we feel that the information contained therein is of such value as to merit a careful perusal by all those interested in this important subject.

We will appreciate any suggestions or information which will tend to make future issues of this book more valuable.

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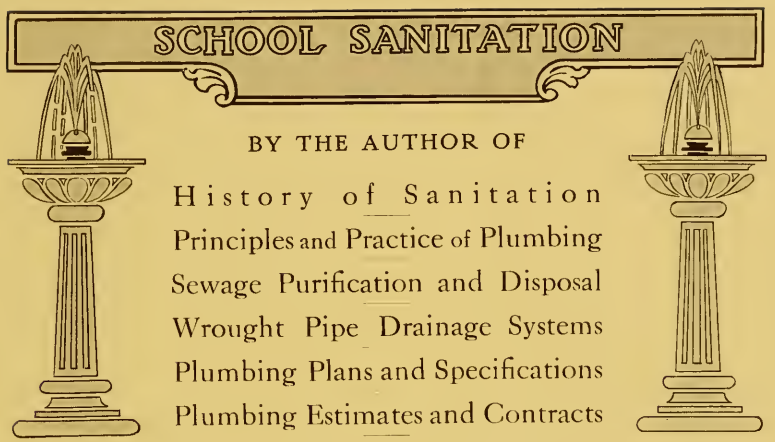

BY THE AUTHOR OF

History of Sanitation
Principles and Practice of Plumbing
Sewage Purification and Disposal
Wrought Pipe Drainage Systems
Plumbing Plans and Specifications
Plumbing Estimates and Contracts
Design of the Turkish Bath
Sanitary Refrigeration and Ice Making

several of which books are widely used as texts in colleges and schools teaching sanitation, plumbing architecture and allied subjects.

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SCHOOL SANITATION

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SCHOOL SANITATION

BY

J. J. COSGROVE

"'Tis Education forms the common mind,
Just as the twig is bent, the tree's inclin'd."

SANITATION in the school house is of far more importance than in any other type of building, for while in other buildings the chief ends to be considered are health, and economy of operation and maintenance, in the school there are health, EDUCATION and economy of operation and maintenance. Even more.,—the Protection to health afforded by good sanitation is of greater importance during the growing and formative period of childhood than ever after, for "as the twig is bent the tree's inclined;" and in after years when the child is a man, he can run away from foul surroundings, whereas the Truant Officer permits no escape from the danger and disgust of foul school sanitation.

Every consideration it would seem demands that the best, and only the best, of sanitation be provided, particularly in the elementary schools of the country; yet, in spite of this fact, nowhere will worse plumbing and poorer sanitary conditions generally be found, than in the elementary schools of the Nation.

The reason for this state of affairs is to be found, not in a desire of those in charge to economize, or a feeling that anything is good enough for the children, but from a lack of knowledge of just what provisions should be made for the schools to give the children the best of sanitary protection. To remedy that condition, this chapter is written.

The Child is Father to the Man

The first mistake it would seem arises from looking upon the school children as sort of feeble minded from their extreme youth, and treating them as we would if they were unable to take care of themselves. No greater error could be made, however, or no greater injustice done to childhood. Man is only boy grown tall. In natural aptitude, quickness to discern, and a desire to find out "how the wheels go round" he can not be ranked in a class with the children he underrates. If the boy does not understand how a fixture is operated when he first goes to school, he will not be there many days before he knows more about it than men who have been using them for years.

What ought to be done then is make no distinction between child and adult, but fit up the sanitary accommodations for children in the schools the same as would be done for adults. In the home the child uses—and does not abuse—the plumbing fixtures; then why should we expect him to abuse them in the school house? By far the great majority of children have sanitary appliances in the home and are entirely familiar with them. Those who have no sanitary appliances in the home, must and should have access to them in the schools. It is part of their education, necessary to their success later in life. What profit it, then, to teach a child all the languages both living and dead, if he is not first taught the common decencies of life? The school is the place to learn the things that can not be learned at home, and if the right use and care of sanitary appliances are among the things to be learned, how can it be taught if barn-yard accommodations only are provided in the schools?

Vocational Training in Schools

The tendency of the times is towards vocational instruction. It is a recognition by educators of the fact that he is most highly educated who can do the greatest number of useful things. It is a placing of useful knowledge ahead of polish and finish, and in keeping with that tendency schools of the future will teach swimming, dancing, sanitation, hygiene, household economy, business in all its branches, before they take up the dead languages and higher mathematics. Sanitation, and the use of sanitary appliances, then, becomes an important part of one's training or education. He must acquire it somewhere before he can succeed in life, and in the school is where he should receive his first lessons. Here he must see the best of plumbing fixtures, the same as he must see the best of pictures, to cultivate in him a high, not a low, taste for art or sanitation.

It is erroneously believed that school children are destructive and will wantonly mar, deface or destroy a valuable fixture. It is even pointed out that the isolated out-buildings of old were defaced by knife marks, and covered with low rhyme and verse.

Where some of the little tots—school children—come from. Where can they learn the care and use of plumbing fixtures, and the principle of Sanitation, if not in Schools? They are our future citizens, the "people"; and their school training should fit them for their duties as such.

Vandalism of Childhood The logic is not good, however, which draws that conclusion from such evidence. Duplicate the conditions inside a school building which existed in the old out-house, and the actions will be repeated. It is the condition, not inherent destructiveness which causes the act. We all hate the ugly, the foul and filthy, and children are no exceptions to the rule. They show it in all their actions. It is only the dirty, the ugly and filthy they destroy. They kill snakes, lizards, toads and other reptiles, but seldom destroy pretty flowers, delicate china or pretty pictures. They will stone the windows out of an old tumble-down deserted "haunted house," while the attractive well-kept building can stand vacant for months without one boy throwing a stone at it.

If, then, we place the children's toilet accommodations in a dark cellar and give them filthy fixtures in dull or dirty surroundings, they will use them, just as adults would, with a feeling of loathing, whenever forced to avail themselves of the doubtful advantages. And dreading to touch the devices, they will not be over scrupulous as to the manner of using them; while should they become broken or destroyed, a fierce exultation will overwhelm them, "even as you and I."

Study of Child Nature The lesson we learn from the study of child nature then is to provide the best and most approved sanitary fixtures, in which nothing is allowed to remain and fester, an eye-sore to all who must use them, but from which the contents are whisked out leaving the fixture sweet and clean after each use. Set these fixtures in a room flooded with light, bathed in pure fresh air, and surrounded with walls and floors of impervious materials smooth and white, and the main principles of school sanitation have been complied with.

There may be variation in the design of fixtures used, and the way they are installed; but the requirements of light, air, color and cleanliness are absolute. If the toilet accommodations are clean and white, located in bright cheerful rooms which are scrupulously clean and well ventilated, the most pronounced vandal among the children will not feel inclined to deface any portion of the room or equipment. On the contrary, they will take pride in it.

Water Closets and Urinals As the water closets and urinals comprise the bulk of the plumbing work in school buildings, and as these fixtures take care of the most objectionable parts of the sewage, it is but natural that they come in for the greater part of the consideration.

It is assumed that every school, whether city or country, will install the proper and necessary water closets and urinals. The accident near Cincinnati a few years ago in which nine school children suffered most loathsome deaths when the floor of an out-house gave way precipitating them into the contents of the vault beneath, where they were smothered, is enough to deter any community from resorting to that disgusting and unsanitary practice. With the simple methods of sewage disposal now available, even schools remote from public sewers can have modern sanitary appliances; and there is no community so poor, nor any school so unimportant, that it can get along without them. This is particularly true now that a movement is sweeping over the country having for its object the use of schools as civic centers where meetings can be held, questions of the day de-

bated, dances given, and other amusements provided for. In view, then, of the various uses the school building of the future will be put to, even in the rural districts, it cannot depend for its sanitary arrangements on an exposed shed in the school yard.

Location of Toilet Rooms The location of toilet rooms in school buildings is now considered differently for kindergarten and primary schools than for advanced schools and colleges. In advanced schools and colleges the practice in the past was to group all the fixtures together in one place, usually the basement of the building, and less frequently in a detached building which was seldom heated and which was otherwise deficient in sanitary requirements. More recently, however, the tendency is to break away from that unsatisfactory practice, and treat school buildings so far as toilet accommodations are concerned, as office buildings, hotels or other public structures. That is, place separate toilet rooms on each floor of the building so that students from the several floors will have separate accommodations. Such practice breaks the entire student body up into several scattered groups, avoids overcrowding with consequent carelessness, and seems to give better satisfaction in every way.

Urinals are dispensed with in these toilet rooms, the same as in the home; and indeed the toilet rooms resemble to a great extent the toilet accommodations in a private house with which the children are supposed to be familiar.

The separate class-room toilets are conducive to better morals, discipline and sanitation, and the pupils can be trained in the proper use of plumbing fixtures if they do not get that training at home. It cuts out a source of moral contamination that exists in the congregate closet system, where a score or more of children can meet at any time, to learn all sorts of evil as well as do damage or commit nuisance with little fear of detection.

Into these "homes" the gospel of Sanitation can find its way, only through the medium of the Schools.

Clean bodies, clean surroundings and clean Sanitary appliances in the school rooms, set a standard they will try to live up to in the home. The little girl in the picture shows unmistakably the refining influence of good school surroundings.

Toilet Accommodations in the Kindergarten In kindergarten and primary schools for pupils under the age of twelve to fourteen years, the toilet accommodations for each classroom may well be located in separate and individual toilet rooms adjoining the class rooms. To reach the toilet rooms it is well to arrange the floor plan so the children will have to pass through a clothes room first, as by this arrangement any embarrassment due to self-consciousness is relieved, and at the same time owing to the two doors sound will have to pass through, it will be pretty well deadened. Of course noiseless operating closets should be used in these toilet rooms so the original noise will be reduced to the minimum.

In the children's toilet rooms, children's closets 12 inches in height may very satisfactorily be used. Likewise the lavatories should be set lower than the regulation height so the children can use them without inconvenience.

Number of Fixtures Required In the United States there are no standard rules for apportioning water closets and urinals in schools, and the only guides are plumbing equipments now in successful operation and found sufficient. Judged by this standard about one water closet is required for each fifty male students or

fraction thereof, and two urinals for the same number. For the girls, at least two water closets should be provided for the same number. In cases where separate water-closet compartments adjoin class rooms, one water closet for twenty-five children will be found the greatest possible limit, and one to twenty would prove safer. In the matter of water-closet accommodations it is better to be liberal than not have enough, for at the worst, a less number of fixtures are required in schools than in almost any other class of building where a large number of people congregate. This is due to the fact that schools are used for only a few hours during the day, and the closet accommodations are more for emergency cases than for regular use.

TABLE I

NUMBER OF TOILET FIXTURES FOR SCHOOLS

NUMBER OF CLOSETS	WATER CLOSETS			URINALS
	GIRLS	BOYS	INFANTS	BOYS
Under 30 Children	2	1	2	2
30 to 50 Children	2	2	3	3
50 to 70 Children	4	2	3	4
70 to 100 Children	5	3	4	5
100 to 150 Children	6	3	5	7
150 to 200 Children	8	4	6	10
200 to 300 Children	12	5	8	15

BATHING IS LARGELY A MATTER OF CONVENIENCE.

How many who delight in their morning baths would take them regularly if they had to take a cart-load of goods out of the tub first, and replace them when through? In many tenement "homes" space is so crowded that the bath tub—when there is one—must of necessity be used for something else. Perhaps for a bed. A bath filled with household goods is shown in this illustration.

Reverse conditions and place the dwellers of such quarters in cultured surroundings, and they would one and all become devoters of the bath; while those who take their morning baths now, if forced to dwell in such surroundings, would soon slip back into the great army of the unwashed.

In Great Britain the number of closets and urinals required in schools has been given considerable study, and has received official action. The number of closets and urinals required for schools of different sizes can be found in Table I.

Types of Water Closets The water closet for school work must be of vitreous porcelain or porcelain enameled ware, enameled on the inside and outside; of the siphon action type containing a sufficient body of water to completely submerge and deodorize the contents. Simplicity of construction and operation, together with strength and durability are among the essentials. The closets may be seat operated, or operated by hand. When seat operated closets are to be used, however, great care should be exercised in selecting them, for the water closet is the most abused fixture in the plumbing installation, and only the best of seat action closets will stand the wear and tear without soon getting out of order and proving ever after a source of annoyance and expense.

There is no reason why a seat action closet should be selected instead of the ordinary type. The pupil will surely know enough to operate the closet after use, and if not, the school is the place for him to learn this simple matter of decency.

Quick and strong siphonic action, small fouling space, thorough imperviousness of the materials, strength and durability are among the qualities to

be looked for in a school closet. Added to these must be a metal-to-metal connection to the soil pipe, for no water closet can be considered sanitary which depends upon putty, a gasket or a slip-joint for a seal. Likewise a flexible section of soil pipe should be used to protect the closet from damage due to settlements, shrinkages, expansions and contractions of the building or drainage system.

Urinals and Urinal Compartments There are two types of urinals now in use, one a urinal bowl attached to the wall or to the back of a urinal stall; the other a stall over the back of which water flows in a thin film. When urinal bowls are to be used, they should be of the design which contains a body of water and can be flushed after use the same as a water closet. When urinal stalls without urinal bowls are to be installed, they should be of some non-absorbent material having a smooth enamel or gloss, or capable of taking a high polish like marble. A light tone, white or cream color, is advisable as it reflects the light better into dark recesses, looks cleaner at all times, shows dirt so the janitor will have to keep it clean, and presents a bright attractive appearance. Dark gray and black slabs, while they might be non-absorbent, hide the dirt, absorb the light, and never look clean and attractive. Besides they seldom take a high polish. These remarks about urinal slabs apply whether the material is to be used simply as stalls for urinal bowls, or form the urinals themselves, and over which the water flows.

When the stalls are to be used as urinals without any bowls, a suitable flushing device is necessary to insure a thorough distribution of water over the entire area to be flushed. This is a very important consideration for the reason that very few devices will continue to operate satisfactorily spreading the water over the entire surface. Some of the parts clog with rust or sediment from the water, thereby leaving parts of the slabs without being flushed.

Water Closet Compartments The rooms in which water closets and urinals are installed must be bright, well lighted, cheerful, free from odor and finished with non-absorbent materials. The floors are best finished with tile. Cement is not impervious and is not a suitable material for around closets or urinals. The walls may be of marble, tile, glass or similar materials of a light color, while the closet stalls are best made of some light colored impervious and fire-proof material like marble or structural glass. Such materials are easy to keep clean, require no painting or varnishing, and save in upkeep what they cost originally. Artificial lights should be located above the closet compartments so that a flood of light will make known the condition of the stall and seat.

This is a photographic reproduction of a boys' urinal in a school building. Just fancy the sanitary condition of that school! Has a truant officer any right to force children against their will, to attend a school where such accommodations only are found? Would you be over scrupulous about the way you used this "convenience?" Can you blame boys for destroying it in the hope that they will get better, and with full knowledge that what they do get cannot be worse?

What sort of ideals of sanitation and cleanliness will boys imbibe at a school where such conditions exist!

Can the moral tone of childhood be improved by such conditions?

Ventilation of Toilet Rooms To keep the toilet rooms free from odor, particularly in cold weather when the windows are closed, it is necessary where a number of water closets and urinals are grouped together, to have

GIRLS' "TOILET ROOM" IN A PUBLIC SCHOOL.

Would YOU send YOUR daughter—would you permit her to attend a school with such accommodations?

Where is the refining influence, the air of culture about such conveniences? Depend on it, no such toilet accommodations are found in the good private schools of the country where girls are sent to be "finished." The plea of economy might explain but cannot excuse such a toilet room in a public school. No matter how poor the community, there is enough wealth to make the improvements necessary. If not, publication of the fact will bring to the fore some public spirited citizen, who will donate the necessary equipment.

the room well ventilated. It might be well to say a word of warning here against constructing a toilet room which is entered by descending a few steps from the corridor. Such design brings the doorway leading to the toilet room near the ceiling of the toilet room where the hottest air and foulest odors rise. The result is, the moment the door is opened the nostrils are assailed with an overpowering stench, while much of the foul air escapes to the corridor and to other rooms of the building.

This condition should be carefully guarded against and with a little forethought and study can be entirely eliminated. On the following pages the question of ventilating the toilet room is described more in detail. It is a subject of great importance and should receive careful consideration.

Local-Vent Closets There are special local-vent closets made for the purpose of ventilating the rooms through the closet bowls, when a number of fixtures are grouped together as they generally are in public buildings. These local vents must have an area each of at least eight square inches, and must be connected to a vent shaft having a positive draft insured by mechanical means.

Instead of ventilating the rooms through the local vents of the several closets, they may be vented through registers located back of the closets. Either method may be employed in the boys' toilet rooms, local conditions determining in each case which is the better. If, for instance, the toilet room is at a lower level than the approach to the room, as previously explained, the better practice by far would be to vent through the closets. If there is any reason to believe that the air of the room would be heavy, the local vent method would be the one to adopt. Otherwise, either method will give very satisfactory results.

In the Girls' toilet room, however, for hygienic reasons the rooms should be vented through registers back of the closets, not through local vents in the closets.

Teachers' Retiring Room In addition to the general toilet accommodations for the students, each floor of a school building should be provided with a retiring room and toilet accommodations for the teachers.

This is a detail too often overlooked in the design of school buildings although it is as necessary as toilet accommodations for the children. The teachers should not be forced to mingle or associate with the children on the intimate terms common to the democratic surrounding of a public toilet room. It is liable to breed familiarity, a condition that should not exist.

Janitor's Room and Slop-Sink On each floor of the building provision should be made for a closet or room in which the janitor can keep his cleaning implements; and a slop-sink at which he can draw clean water and dispose of the waste water from scrubbing and cleaning. If a slop-sink is not provided, he must

of necessity use the closet bowls for disposing of the waste water, and this is sure to damage the closets, no doubt breaking many of them, for they are not designed for that rough service. A janitor's slop-sink on each floor of the building will pay for itself over and over again each year in the saving of wear and tear on the other fixtures.

Emergency Room or Infirmary A provision which should be made in all large buildings where a number of people congregate, and which is particularly desirable in a school building, is a room set aside as an infirmary and equipped with the fixtures necessary for emergency cases. For instance, there should be a lavatory, a water closet, bath tub, and possibly a hospital sink, while in cities where the school children have their teeth examined, a practice which might well be adopted in every city, the necessary fixtures for the dental purposes would be required. Provision for an infirmary has been neglected to a great extent in the past, but it is more than likely that the action of a few of the Eastern cities, notably Boston, in providing medical supervision for the schools will be followed throughout the United States when the benefits derived from the system become known.

What Others Are Doing In the matter of supervising the health of school children, we are very far behind many other nations which we do not consider in our class. Argentine, Belgium, Bulgaria, England, France, Japan, Sweden and Switzerland make national provision for the medical inspection of school children, while in America and Germany the practice has not become general, only certain of the cities having taken up the work.

In Boston, at the present time, a nurse is in charge of the physical welfare of the children in each school, to assist in testing the sight, hearing and other

RANGE OF CLOSETS IN A PUBLIC SCHOOL IN ST. LOUIS

There is no evidence of vandalism here. The walls and floors are fresh and clean. The air is pure, no odors can permeate the building; the children learn the use, the convenience and the comfort of good sanitary appliances; while last but not least, the moral tone of the place is elevated.

Note the ventilation ducts near the ceiling. They are large enough to keep the rooms from getting foul no matter how much the room is used.

THE OLD SWIMMIN' HOLE.

Do you remember what a lure to you was the old swimmin' hole, where, after a refreshing dip you could lie on a grassy bank, listening to the hum of insects close by?

It was the water made you play truant. School was a prison and you were a captive. Better freedom and a thrashing than a dull afternoon in the school room.

senses of the pupils, with a view of correcting any infirmity which might prevent their applying themselves to their studies as they should. In addition the nurses are always on the lookout to detect symptoms of contagious diseases like measles, mumps, whooping-cough and fevers.

In order that the nurse will have the proper facilities and a suitable place to conduct her examinations, an infirmary will be found indispensable in schools which contemplate medical supervision. Even where there is no medical supervision, an infirmary containing the fixtures enumerated, and a couch to lie on should be provided. Fainting fits, and other weaknesses are not uncommon where a number of children are gathered together, and a suitable place should be provided for the treatment of the patient in such cases.

nine months of the year. Out of 365 days of the year, on not more than half of them are the schools put to any use whatever.

This state of affairs, in line with the doctrine of conservation of resources, has led to a movement towards the more general use of the school buildings after hours, dedicating them to as many uses as can reasonably be done, without conflicting with the chief and foremost purpose, education or training of the young.

The necessity for public convenience stations in all parts of every city has been recognized for many years, but the cost has restricted them to the crowded business sections only, leaving the various outlaying districts without any conveniences of a public nature, outside of saloons and like places. Now, however, there is relief in sight. There is no reason why a portion of each school building can not be set aside for this very purpose, with benefit to every one in the entire community. There is more or less waste space in the basement of every school building which could easily be put to this purpose. And the cost would be trifling, amounting only to the expense of installing the plumbing work.

"NOON TIME AND JUNE TIME, DOWN BY THE RIVER."

Youth is the time of enjoyment, of activity, when the imagination is fired with thought and stories of adventure, and nowhere can the imagination be given greater license than on the water, be it lake, stream, ocean or canal. It is likewise the time when imagination and action must be guided in the right direction, for the truant age of boyhood is one of the turning points of life.

Public Convenience Stations in Schools There is no other public property, perhaps, which is used so little in proportion to its cost, yet which could be put to more extensive use than the school houses. Hundreds of millions of dollars are invested in school property in each large city of the country, and the schools are used only six or seven hours a day for less than

Public Baths in the Schools In addition to the closet accommodations, public baths may be, and in some cities are provided in the school buildings. Baths for the school children are common to the schools in many cities, while in others the benefits of the bath are being extended, after school hours, to the public at large. For this a small fee can be charged, if

necessary, making this new department self-supporting if not actually a source of revenue. Turkish baths ought to be made an important department of the bathing facilities, where from fifteen to twenty-five cents a person could have the benefit of this remedial treatment. Popular-price Turkish baths

every public school into a public bath house and public convenience station, to be used after school hours. This would not only give the public greater use of the public schools, but would provide conveniences for the entire population which are badly needed now, and help defray the cost of the public schools.

THE SUCCESSOR OF THE OLD SWIMMING HOLE

No clam shells here to cut the feet. Every convenience is here provided, temperature, depth, pure water, games, companions, instructors, light and heat. Showers in the back ground are for washing before entering the pool, to keep the water in its original purity as long as possible.

There will be no truancy in the schools provided with these accommodations, and the physical development of the children will be bettered, training of the mind and body going hand in hand so each pupil will be well balanced.

are as necessary as ordinary baths, and in the school buildings can be worked out many of the problems of inexpensive conveniences for the citizens. The plunge bath is fast becoming a part of every school equipment, and all that remains to make a fully equipped Turkish bath are a couple of hot rooms, which are easily provided. Under the new order of affairs, the class rooms are to be used for public meetings; but the usual sanitary equipment of the building, consisting of toilet rooms and sanitary drinking fountains, will be found sufficient to take care of the public. In fact, outside of the public toilet rooms, and the Turkish-bath hot-rooms, very little extra equipment would be necessary to convert

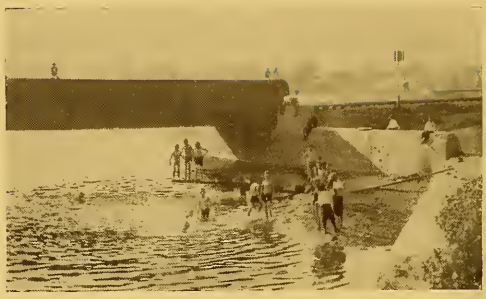
Bathing Facilities in the Schools

The principle is fast becoming recognized that we ought to have facilities for bathing in the schools as well as in prisons and other institutions where a large number of people are thrown together. As a result, the installing of shower baths in school buildings has become a settled practice in some cities, where particularly in the poorer quarters each new pupil is initiated by a bath before taking up his studies with the rest of the children. But it is not in the poor quarters only that bathing facilities are provided and used. Showers and lockers to hold the clothes while the children are bathing are provided in all the public schools in those cities and the way the

children take to them shows they fill a long felt want. Boys who object to the usual tubbing at home, take kindly to the showers, particularly so as it is the final touch after exercising in the gymnasium or playing on the school ground. Indeed, the showers become a necessary part of most school buildings now that gymnasiums and playgrounds where athletic sports are held are becoming part of every well-equipped school building. After a game of basket-ball, football or a half hour in the gymnasium a shower bath is almost indispensable to the exercisers.

Swimming Pools The teaching of swimming is being considered seriously by school authorities throughout the country, as it has been by educational authorities in Great Britain and Europe, where swimming pools in school buildings are by no means uncommon. In this country, likewise, swimming pools have been provided in the school buildings of some cities, and no doubt the benefits derived will cause their use to spread to other cities. Many of the old school readers tell the story of a scientist being ferried across the river by a man of no education, whom he quizzed as to the studies he was proficient in. Upon being told the boatman knew nothing about algebra, the scientist told him that one quarter of his life had been lost. Two or three other studies the boatman knew nothing about, proved to the scientist's mind that most of the poor boatman's life had been lost or wasted. Just then he noticed that the boatman was taking off his coat. Upon asking what was the matter, the boatman inquired, could he swim. Upon replying "No," "then" replied the boatman "the whole of your life is lost, for the boat has sprung a leak and will soon go to the bottom."

The moral of that lesson taught widespread throughout the United States is now being applied and in inland cities where natural bodies of water are lacking in which children can learn to swim, the providing of swimming pools becomes as necessary as equipment for any other branch of education. When all the children of the land are taught to take care of themselves in the water, and how to handle others who cannot swim, there will be a smaller annual toll of deaths from drowning, and fewer people who "rock the boat" when on the water. To preserve life would seem to be as important as to support oneself; and it would seem better to teach a boy to swim, than to



WHY DO BOYS PLAY TRUANT?

When in quest of occupation and adventure. They want to swim; they want to learn to dive; they want to splash around in the cool waters of their usual aquatic haunts. The one way to keep them from playing truant, is to provide for them in the school the attraction they seek for outside. Fit up a swimming pool in the school, interest the boys in water games, and no lure offered by the great out doors will tempt them from their companions and their sports.

GOOD CITIZENS IN THE MAKING.

School athletics, in which all take part as competitors for the good of health, not a few for the glory of records, build up the body, and knit together the children in a common bond of interest. Athletic games make the boys manly; develop quick judgment and self reliance, besides keeping them off the streets and from places of questionable morality. If gymnasium, showers, lockers, pool and other equipment did no more, they would justify the cost. Good men and women are the greatest works of nature, and it is the province of education to aid nature in the work.

teach him a smattering of some dead language which he will forget as soon as he is out of school.

Where natural water courses are at hand, the providing of swimming pools is not so necessary, although it would seem that the art of swimming should be taught in schools; besides the pool would furnish amusement for boys during winter months as well as summer, keeping them off the streets, from playing truant and benefitting them in other ways. They will be necessary at all events in schools which have public baths and convenience stations fitted up in them, and it will never be a mistake to make a swimming pool a standard part of every school equipment.

School Kitchens for Domestic Science

The teaching of domestic science —cooking— is now an established branch of education, and in schools where cooking is taught, a room must be fitted up as a kitchen, with sinks for drawing water and cleaning dishes, ranges for cooking the food and heating the water, tables for the pupils to work at, and all the usual utensils, fixtures and fittings common to equipments of that sort. These kitchens can be put to different uses in the future, when the public school buildings are put to the many uses they finally will. For instance, what would be better for the country as a whole, and the cause of education in particular, than to have each girl make her own graduating dress, and the class in general prepare the refreshments served at the graduation exercises and dance?

SHOWER BATHS IN A NEW YORK CITY PUBLIC SCHOOL.
Any school building in the country can be fitted up likewise at comparatively small cost, and with lasting benefit to future generations.

Lunches for the School Children

Then there is another reason why kitchens will be required in schools of the future. At the present time it is safe to say that two per cent. of the children attending school are hungry. This not only causes mental inefficiency, for nobody can work or study to the best advantage while tortured by the gnawing of hunger, but it is furthermore one of the causes of crime. Why, then should not the public schools serve a wholesome noonday lunch to the pupils, even though the practice would seem revolutionary and socialistic? In cities where cooking is taught in the schools, the school authorities do not hesitate to provide foodstuffs for the students to cook, and eat if they see fit; then why should they refuse to provide a like or even greater amount for the underfed school children?

The same good end would be attained in either case, and the necessity would justify the expenditure. If any further justification be needed, however, let it be had in the good that will follow the teaching of food values and posting the growing generation on pure foods, and how to detect doped food stuffs.

No more important subject could be taught in the public schools than the proper feeding of the human race, how to market, how to buy, and how to prepare foods in a wholesome and nutritious way. The cost of this department would come back a thousand fold to every individual, and come back direct in saving of bills, greater energy derived from pure and wholesome foods, so nobody could or would object to the outlay. The meals prepared would then be a by-product of this department which has already paid for and justified itself, so nobody can object to feeding the children with them, when doing so makes better individuals and better citizens of them. For fear it might be thought socialistic to act on this sug-

DEMOCRACY OF THE COMMON DRINKING CUP.

The way untold thousands of children found early graves before the danger was understood and guarded against. If you have a little child in the home, protect her from illness and possible death by insisting on a water of unquestioned purity and wholesomeness, and drinking fountains which will not undo all the other good work of Sanitation by spreading contagion from cup to lip.

gestion, it might be well to record here that in the City of London, England, the practice is in force at present.

Drinking Water for Schools It goes without saying that no drinking water should be supplied to schools which is not perfectly sterile and wholesome in every respect. Because a water is sterile is no indication that it is wholesome, for distilled water is perfectly sterile, yet it is not wholesome or beneficial when used daily. It lacks the natural salt necessary to a potable water and shows very well what is meant by the statement that wholesomeness as well as purity is desired. Unfortunately, there are no means for pre-determining what is a wholesome water. The purity of the water can always be determined by analyses, but whether or not the water is wholesome can be determined only by the experience of others who have used the water.

In cities, where the water is supplied through the city mains, there is no alternative but to use the water so provided, whether wholesome or not. Cities have not arrived at that advanced stage, yet, where they make a distinction between the quality and quantity of water supplied. To them, water is water, whereas, as a matter of fact, there is as much difference between waters as between the different supplies of any other merchantable commodity. Look, then, to the quality of the water to be supplied to the schools, and if there be a choice of supplies, choose that which is best from a wholesome standpoint. A water which is wholesome can be made sterile—but of course no water no matter how wholesome would be accepted unless the source was above suspicion; for at its best, there is more illness enters a building by the water route, than ever entered by way of the sewer.

Water Filters Of course the water must be sterile. If the supply delivered through the mains is not filtered, then in each school a filter should be provided. It will not be necessary to filter all of the water entering the school, however, but that only which is used for drinking, cooking and like purposes.

Right here, though, is where it is necessary to sound a warning against many of the so-called "filters" on the market. Among the little household filters which depend upon a porous stone or porcelain cylinder to purify the water passing through, not one of them can be considered of any value in ordinary practice. True, the Pasteur-Chamberlain filter will give a perfectly sterile filtrate for a short time, but even this filter, the peer of its kind, must be taken apart and the parts sterilized in a hot oven every few days or it will be no better than the rest; and it would never get such care and treatment in any school building. Most other filters of this type are at their best, worse than useless, as bacteria multiply in passing through them, so that the filtered water contains several times the number of bacteria contained in the raw unfiltered water.

The little strainers screwed on a faucet, and called by courtesy "filters" are of no value whatever. They are not good strainers even, holding back only the coarsest of materials.

Operation of Filters There are filters, however, sand filters, which when properly looked after will give a pure drinking water. These may be either "pressure filters" through which the water to be filtered is forced by its own pressure, or "gravity filters" located at a higher elevation than the fixtures supplied, and through which the water percolates by gravity.

But even these filters will not give a sterile water unless a coagulant is used with them. That is, a chemical, usually sulphate of alumina or sulphate of

iron, automatically fed to the raw water before it enters the filter. This coagulant forms a jelly-like layer on top of the sand which entangles and holds back any suspended matter, including bacteria, brought in contact with it. Without the coagulating apparatus and the jelly-layer, the process is simply a straining one, and the water will not be sterile, although it will be clear and suitable for the swimming pool and like uses.

In school work, therefore, particular care should be exercised, not only to provide coagulated apparatus for the filters, but to see that the apparatus is kept supplied with coagulant and in good operating condition; and that the filters are cleaned at suitable intervals—a simple matter affected by reversing the flow of water—otherwise the water will be no better than if no filter were used.

district. As water is a well-known channel of infection, and common drinking cups a mode of infecting the water or communicating a disease by direct contact, the use of common drinking cups, or fountains which require the use of them, should give way to the sanitary drinking fountain. Even then watchful care is necessary to keep the fountain from being contaminated. Children like to play in water, and it is not an uncommon sight to see them rubbing their hands—sometimes very dirty hands—over the cup of the sanitary drinking fountain over which the water flows to the drinker's mouth.

Sewage Disposal The city schools have the problem of sewage disposal worked out for them in advance, in a system of public sewers into which the sewage can be discharged.

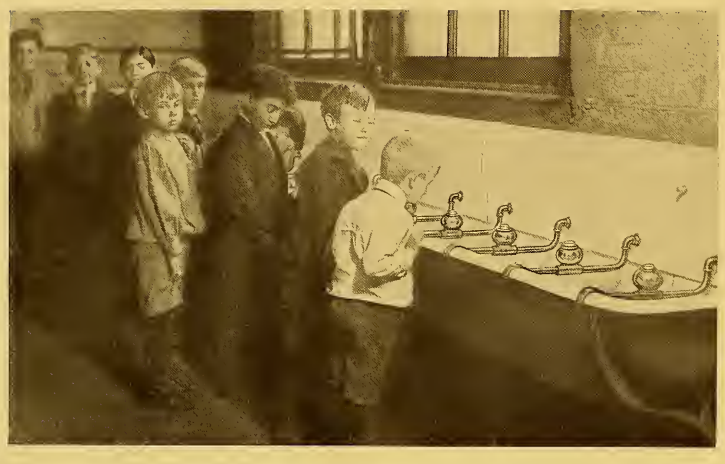
Children in a large city public school drinking out of common drinking cups before bubble fountains were put in. Note the color democracy in this group, in which weak and strong, healthy and diseased drink together. Would you want your children to drink from such a cup?

Drinking Fountains Drinking fountains of a sanitary type which require no cups, or else individual drinking cups, should be provided for the school children. The ordinary drinking fountain with one cup for the use of all the children is unsanitary in the extreme and goes a great way towards making epidemic cases of diphtheria, mumps, and whooping-cough, not to mention the possibility of communicating the bacilli of tuberculosis from lip to lip. In a school building children come from all parts of the school district, mingle together for a few hours, then separate; and if one child is affected with a communicable disease, great danger exists of it spreading to others, thence to the whole

Country and suburban schools are not so fortunately situated, and sometimes city schools are built in the outlying districts before sewers and water mains have been extended to them. When such is the case, a safe, sane and sanitary method of disposal must be adopted, and whatever method this might be, see to it that it is not a cesspool. At no greater expense than the cost of a cesspool, a small sewage purification works can be installed, consisting of septic tank, aeriator, and sand filter, all under ground concealed from view, inodorous, effective, and taking up no space on the surface of the grounds. Further, in place of being a menace to the entire community and the inmates of the school, as a cesspool would be, and possessing

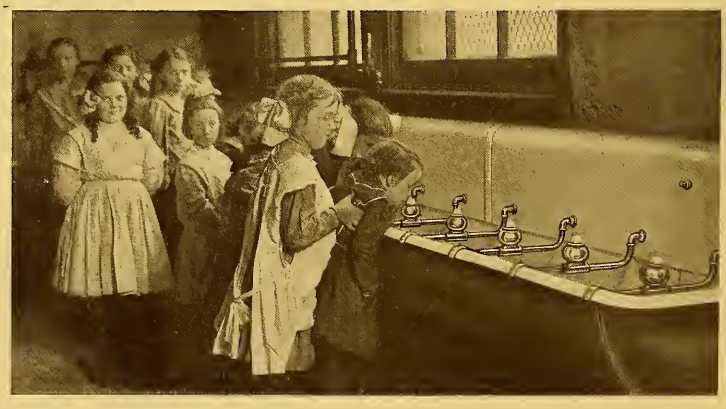
the additional danger of caving in when some of the children are walking over it, the sewage purification plant will prove absolutely harmless and not the least bit objectionable.

Under no consideration should the old-fashioned out-buildings be resorted to, modern progress having made these no longer necessary, if indeed they ever were; and for sanitary reasons, as well as for the reasons before mentioned, they should no longer be tolerated.



BUBBLE FOUNTAINS WHICH REPLACED THE COMMON CUP IN A LARGE SCHOOL

A cup which had been used in a high school, for several months without having been washed—a disgusting fact in itself—was found upon examination to be lined inside with a thick brown deposit. Under the microscope this deposit proved to be composed of particles of mud, thousands of bits of decaying skin, dead epithelial cells, and millions of bacteria. To determine the virility or harmlessness of this sediment, some of it was injected under the skin of a healthy guinea pig. Forty hours later the pig died and an examination showed pneumonia germs had caused the death. Another pig inoculated with some of the sediment from the same cup, developed tuberculosis.



The Heating and Ventilation of Schools In considering the methods of heating and ventilation to adopt for schools, the first two principles to keep in mind are that there are different kinds of heat; and that it is well to consider the heating and ventilation separately, not as one combined system, as is too often done.

On an early spring morning with the temperature somewhere around 50 degrees Farenheit, you have no doubt stood in a sheltered nook out doors where the sun beat down, and you experienced a delightful sense of warmth, a genial glow, while the lungs drew in copious drafts of cool, vitalized air. It is in those sunny nooks that the first flowers put forth their blossoms, and the first games of marbles are played, unconscious of the fact that the air is cold.

The reason for this comfort is found in the fact that you were warmed by *radiant heat* a peculiarity of which is that it will pass freely through space without raising the temperature of the air through which it passes. It warms the body, but not the air, so that while comfortably warm one can breath the cool invigorating air.

In mid-summer we have the other condition or method of heat. The sun beats down fiercely on wall and pavement, warming them to an uncomfortable degree. The air passing over these surfaces is heated to a high temperature and we walk about in a sea of hot air. Seeking the shade brings but little relief, for the air we breathe is devitalized, the heating evidently depriving it of some of its invigorating qualities; and while we gasp for air, we are shriveled up by the

moisture wrung from us to supply the lack of normal humidity of the atmosphere.

Quality of Heat In the first case we have the condition known as radiant heat, such as that supplied by stoves, direct steam radiation, or hot water heating. In the second case we have the condition brought about by the system of hot-air heating; indirect steam heating; and fan or blower systems of steam heating. As a simple principle of heating, then, direct radiation is unquestionably the best; but in hot-air heating and indirect systems of steam heating, the functions of heating and ventilation are supposed to be combined. Let us see how true that is.

It must be admitted that with hot-air systems and indirect steam heating, air is introduced to the buildings in a continuous stream, and after use passes out again through specially provided vent ducts. But ventilation—real ventilation—is more than passing a stream of air through the various rooms of a building. The *quality* of the air must be considered, and unless the quality is good, the ventilation is poor, no matter how large a supply is provided.

School Ventilation The ideal ventilation, of course, would make the interior of buildings like the world outside. That is a standard, however, we can hardly expect to attain, although we can strive for it. In none of the combined systems of heating and ventilation can this condition be even approximated, for as the walls, floors, ceilings and contents must be heated, and the heat loss supplied from the heated air, the air must of necessity be heated way above the temperature at which the rooms are to be maintained. Heating the air above, say 70 degrees Farenheit, robs it of some of its vitality, and when the air is heated by passing over the hot iron plates of a furnace—sometimes red hot—or through steam coils having temperatures of from 212 degrees to 300 degrees Farenheit, it seems to be "burned" if the expression may be used. At all events, some of the more volatile and health-giving elements are burned out or driven off, leaving a poor air of low quality.

The thing to do then is to separate the heating system from the ventilation system, making them entirely independent of each other, yet working in harmony. For instance, heat all the rooms of the building by *direct radiation* locating the stoves or radiators in the rooms to be heated. There will be no question, then, about the inmates being warm at all times, even when the windows are open and a flood of pure fresh air of lower temperature is sweeping through the rooms.

For ventilation, fit up the supply and exhaust ducts and shafts as is now done for the heating and ventilation system, but instead of supplying air of sufficient quantity and temperature to heat the building, send it to the rooms in a gentle stream and at a temperature of not over 70 degrees Farenheit, and containing the normal amount of humidity. Instead of small coils at high temperature to heat the air, provide large coils of low temperature, so the air cannot be burned or de-vitalized; you then have at no greater cost than for the combined system, separate heating and ventilation systems operating harmoniously and approximating as nearly as possible the radiant heat of Nature, and the fresh air of out-doors.

THE BUBBLE FOUNTAIN IN A CHILDRENS' PLAYGROUND.

Democracy here without the common drinking cup. A happy group of children just out of the plunge bath. Where there is such an attraction for them, no danger of them forming bad habits, keeping bad company, or getting into evil ways.

In the interest of better sanitation, better heating and ventilation, it is well to know that all our present methods of ventilation are, at the best, mere experiments; a groping towards the ideal. Until such time, therefore, as experience and experiment have determined accurately the best method of ventilation, it is safest to deliver to the children the air in all its original purity, without heating it or otherwise treating it more than the exigencies of the case absolutely demand. In severe climates like the northern part of the United States and Canada, during exceptionally cold weather the air used for ventilation must, of course, be heated some before discharging it into the

rooms. The less it is heated even then, the better; while in all cases it would seem the best policy to supply more radiant heat when the weather is cold and let the air introduced for ventilation be as cold as the children can stand.

The Food For School Children

To make strong, vigorous energetic men and women of future citizens, start by teaching the school children what to eat and drink, and what to let alone. Once they have these principles impressed on their minds while young, they will stick to them throughout their lives.

More health is wrecked during the period of early adolescence by the "foods" eaten and drug habits formed, than by all other causes combined. Adolescence is a critical period of childhood, when of all times only the best and most suitable foods should be taken. Unfortunately it is at this time that children err the most against the laws of hygienic eating. The girls take too large quantities of candy—seldom pure—soda water, "soft" drinks often containing habit forming drugs, greasy "shop" pastry, and coffee. The boys feeling the call to do something "manly" take to cigarettes and alcohol.

It is a mistake to try and overcome this tendency of boyhood by pointing out the dangers of alcohol and nicotine. It is the very fact that they risk health which gives to the acts the element of daring, and makes them in their own eyes heros for taking the risk. If you want to get boys to do a certain thing, tell them it is dangerous. The love of adventure or of risk and daring, will lure every boy with good red blood in his veins to do the very things pointed out for him to avoid as dangerous.

The way to control them is to lead them, not try to frighten them with a mental picture of the consequence of their acts. In the flush of youth, health and strength, every boy has a certain contempt for the agencies of sickness and accident, and feels immune from illness of any kind. They are too remote in his consciousness to affect him. They might overtake others, but he is different.

But every boy has his blind side—his easy avenue of approach, and that is his admiration for and desire to be an athlete. That is the cord to play upon. Girls, too, have their pardonable weakness—the desire to be pretty and attractive.

Teach them, then, that perfect health is the first requisite for the fulfilment of these ambitions, and that perfect health can be had only when the blood coursing through their systems is absolutely pure. Even then there will be a difference in their relative strength and beauty, but no one can be strong and attractive without pure blood in their bodies.

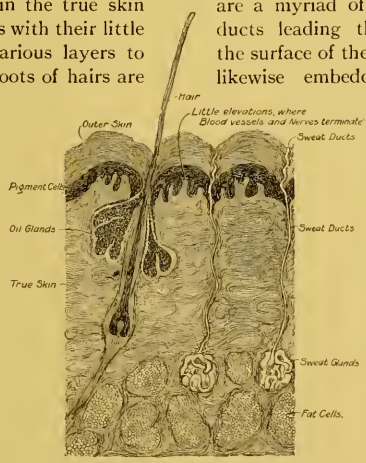
Pure blood cannot be had if unfit food is eaten and cheap candy, highly-colored soda water, doped "soft" drinks, greasy pastry, excessive meat, coffee, tea, tobacco and alcohol, are among the articles which must be classed as unfit foods.

HYGIENE OF THE BATH

Authors Note:—As bathing has a beneficial or injurious effect on the system according to whether it is rightly administered or improperly taken, it is necessary that **teachers** and **school authorities** know the various effects of different baths, so that children,—particularly weak children—can be guided to a proper use of water which will build up, not tear down. So that this information will be readily available, it is here made part of School Sanitation. Every teacher should read it.

STRUCTURE of the skin.—If the section of a piece of healthy skin be viewed through a microscope it will be found, as shown in the illustration, to be a many-functioned organ instead of a mere covering to protect the external surface of the body and support the internal organs. The outer, or scarf skin, will be seen to be made up of numerous scalelike cells of a horny consistency, which are being shed constantly and replaced by younger cells from below. Immediately beneath the outer, or scarf skin, is a layer of pigment cells. It is the difference in quantity and color of pigment deposited in these cells which gives to different races their characteristic colors.

Indenting this pigment layer at frequent intervals, so frequent, in fact, that fifty-seven thousand may be grouped together in one square inch of space, are little elevations, or centers, where blood vessels and nerve fibers terminate. Underneath the terminal of nerves and blood vessels is the true skin, which is sensitive. Beneath the true skin are fat cells embedded in fleshy tissue. Bedded deep in the true skin are a myriad of sweat glands with their little ducts leading through the various layers to the surface of the body. The roots of hairs are likewise embedded in the true skin, and the stems extend out through oil ducts, which serve to conduct forth the oil secreted by the glands.



Microsopic Vlew of Healthy Skin.

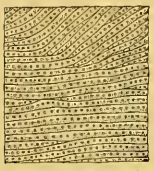
Oil Glands A sectional view through an oil gland, oil duct and hair is shown, greatly enlarged, in the next illustration. The root of the hair has its origin below the gland, where it communicates with a nerve cell to give it the sensation of touch, and with a blood vessel to supply it with nourishment.

The Hair Up through the center of the oil gland grows the hair and passes out to the surface of the skin, through the little oil duct, through which the gland pours forth its lubricating and softening fluid to the surface of the body. Oil glands, which are quite numerous, are scattered over the entire surface of the body, a gland and duct being found wherever there is a hair, as well as in many places where there are no hairs. The total number of hairs on the human body may be judged from the fact that there are estimated to be one hundred and twenty thousand hairs on a normal scalp.

Oil Gland, Oil Duct and Hair

Sweat Glands More important, perhaps, than the oil glands and ducts are the numerous sweat glands embedded in the skin and the minute ducts which conduct their fluids out of the body. On the cheeks there are only about five hundred and fifty sweat glands per square inch; on the forehead there are twelve hundred glands per inch, and on the soles of the feet and palms of the hands, where they are the most numerous of any part of the body, they number as high as twenty-seven hundred per square inch. The little sweat tubes where they pierce the outer skin of the palms of the hands can be seen by a microscope dotting the curves, circles and whorls which make up the intricate patterns of the skin. These tubes can be seen, greatly enlarged, in the succeeding illustration. According to careful computation there are about

one million five hundred thousand sweat glands in the entire body, the total length of which has been variously estimated at from 2½ to 28 lineal miles. When the number is conservatively estimated, however, the total length of perspiratory tubes will be found in the individual of average size to be less than 3 lineal miles. If the coils of the little sweat glands shown in the illustration were unraveled and stretched out in a straight line it would be found that the combined length of sweat duct and coils of the gland measured about one-fifteenth inch. If the total number, one million five hundred thousand, were then placed end to end, they would be found to measure about 166,666 lineal inches, or 2.63 miles in length.



Sweat Pores in Palm of Hand

Sweat Glands and Ducts

It will be noticed that near the mouth of the tube the little sweat ducts are not straight, but take a tortuous or spiral course, like the coils of a spring or the spirals of a corkscrew.

Functions of the Skin When speaking of the skin, not only the scarf-skin and cutus, or true skin are meant, but likewise are included the various organs, glands, ducts, nerves and blood vessels embedded in the skin. The outer, or scarf-skin, being intended principally as a protective covering for the body, is admirably suited to that purpose. Made up as it is of numerous layers of scalelike cells, composed of a horny substance, like the hoofs and horns of cattle, it is tough and will withstand an incredible amount of wear, while at the same time it is soft and pliable. This layer of the skin contains no blood vessels, so that it will not bleed when cut or scratched, and as it possesses no nerve centers is utterly devoid of feeling. The outer scales of this layer are constantly peeling off, exposing younger and more tender ones below, which are better suited to normal conditions. When, however, certain parts of the body are exposed to great wear—as, for example, the palms of the hands—a thick layer of horny scales or callus forms to protect those parts. The dead scales, which have become detached from the skin, or which hang like ragged particles to the surface, require periodical removing or they will putrefy on the body and perhaps clog some of the oil ducts or sweat pores.

Effect of Oil on the Skin To keep the outer skin, or scarf-skin, in a soft, smooth and pliable condition the various oil glands pour out their secretions of fatty matter, or oil, to lubricate the surface of the body.

When for any reason the action of the oil glands is interfered with or the ducts become obstructed no oil can be poured out onto the skin, which then becomes harsh and rough to the touch and, probably, chapped. The chapped hands most boys have in winter weather will readily present themselves to most people as an example of such lack of activity of the oil glands, while the remedy, application of oil or grease to the rough parts, is simply doing artificially what nature does automatically, and without our being conscious of the fact. A turkish bath will likewise remedy the chapped condition by cleansing the surface of the skin and allowing the oil and sweat glands to perform their normal functions. Internal cleansing of the alimentary canal will likewise remove the stored up impurities, and bring the skin back again to a normal condition.

Pigment cells The pigment cells under the scarf-skin play a more important part in maintaining perfect health in the individual than would seem possible to the casual observer. The function of the pigment deposited in these cells is to prevent the penetration of harmful rays of light into the deeper tissues of the body. The action of the nervous organism in filling these pigment cells when necessary for the protection of an individual will be recalled in the "tanning" of dark-complexioned people when exposed to strong sunlight, and the sunburn, with subsequent tanning, of light-colored people when exposed to the direct rays of the sun. From all indications, the pigment of skin plays some part in nutrition.

So far as the bath is concerned the pigment cells are of no further interest, for the bath has no effect on the cells and the cells in no way interfere with the bath. In institutions where light baths are given, on the contrary, pigment, or the lack of pigment, in the cells would have to be considered for not only has the pigment, or lack of pigment, a direct effect on the person subjected to the light but, conversely, the intensity and color of light ought to be tempered to the color and amount of pigment in the cells.

The nerve centers which terminate in little elevations just beneath the layer of pigment cells impart to the skin the sense of touch, so that it will be sensitive and respond to influences of heat, cold, electricity or friction. The blood vessels,

working in harmony with the nerve centers, drive the blood from the surface of the body at times, then, responding to some reaction, like heat or massage, draw it again to the surface and the skin takes on a healthy glow.

Functions of the Sweat Glands

Of the numerous functions performed by a healthy skin there is, perhaps, no one gland, duct or vessel which plays a more important part than the little sweat glands. Through their pores these little glands, when in a healthy condition, throw off from the blood about two pints, or two pounds, of waste matter daily. In doing so the action of the glands is continuous, not intermittent, and the waste matter thrown off is generally in the form of invisible vapor, though when the body becomes warm from exercise or through excessive temperature of the atmosphere the vapor becomes visible in the form of perspiration. In this respect the sweat glands perform the glandular functions of the kidneys, and when the sweat glands refuse to perform their functions an extra burden is imposed upon the kidneys. This in itself would not be so serious a matter if the sweat glands and kidneys performed the same functions and were interchangeable in that respect, as they seem to be. As a matter of fact, however, they are not, for the function of the kidneys is to void fluids of an acid reaction, that being the normal reaction of urine, while the sweat glands excrete an alkaline solution, that being the normal reaction of perspiration. By exciting either of the organs they can be made apparently to perform the function of the other, but it is extremely doubtful if they actually do so. By exciting the sweat glands the fluid which would normally be voided by the kidneys can be carried off from the system in the form of perspiration; but what becomes of the poisonous or deleterious acid constituents of that urine—are they carried off likewise by the sweat glands, which were not designed for the purpose? It would seem not; and, if not, such impurities will remain in the blood, accumulating with time, until the health of the individual becomes undermined. On the other hand, by exciting the kidneys much of the fluid required for perspiration may be carried off as urine. But, as the kidneys are intended only to filter out the acid wastes, what becomes of the alkaline matter which should be carried off through the sweat ducts? It would seem that each of the organs—the kidneys and the sweat glands—have separate and distinct functions to perform, and that one cannot successfully perform the functions of the other; even if it could it would seem an unwise policy by neglect of the person to require the kidneys to carry off daily the two pounds of matter ordinarily excreted by the sweat glands, or the sweat glands to carry off the waste ordinarily voided by the kidneys. That the kidneys or other organs cannot carry off the poisonous matters excreted by the sweat glands is proved by the fact that if the skin be varnished death will quickly result, due, no doubt, to the retention of some poisonous substance the nature and production of which are not understood; while the kidneys can be put out of service for a much longer time without fatal results.

Interchangeability of function of Sweat Glands and Kidneys

Comparison of matter thrown off by skin, kidneys and other organs

To say that the sweat glands throw off two pounds of matter daily in the form of invisible perspiration is to state a fact without interpreting it. The bald statement lacks perspective to show its true size and proportion. A better understanding of this important function of the sweat glands can be had when it is known that the average amount of matter voided by the kidneys in twenty-four hours is approximately two and one-quarter pounds, or but slightly more than that thrown off by the sweat glands; while the solid fecal matter discharged by the average person in twenty-four hours is less than one-quarter pound and the vapor carried off by the lungs during the same period of time is approximately one pound.

There is another function of the skin in which the sweat glands play the most important part, and that is in maintaining a uniform and normal temperature of the body under all the variations of temperature to which individuals are exposed so that, whether in the tropics, near the equator, or in the frozen north searching for the pole, the temperature of any individual would remain constant. The reason why temperature remains constant is because when exposed to a temperature greater than 98° Fahrenheit, or when the body temperature is raised by exercise, the little sweat ducts open wide their mouths and pour forth a stream of moisture proportioned to the temperature or the exertion. The cooling effect of this moisture evaporating from the surface of the body keeps down the temperature, which otherwise would rise to a dangerous or fatal degree. Owing to this wise provision of nature man can live without the least discomfort when exposed to incredible extremes of dry heat. For instance, a man can sit with complete immunity in a hot-air bath raised to a temperature sufficiently high to bake bread or cook meat, and men have habitually sat without

Temperature man can withstand

the slightest inconvenience in the hot room of a Turkish bath where the temperature was 240° Fahrenheit, or 28° above the boiling point of water. Many instances could be cited of persons whose occupations exposed them to temperatures of from 250° to 280° Fahrenheit for long periods of time, and others who have endured temperatures of 360° Fahrenheit for shorter periods of time, but these may be dispensed with and the case of Chabert alone mentioned. Chabert, who was known to the public as the "Fire King," was in the habit of entering an oven, the temperature of which was from 400° to 600° Fahrenheit, and remaining there a considerable length of time.

When exposed to a temperature of less than normal body heat, on the other hand, the sweat glands cease pouring forth their fluid, there is consequently no evaporation from the skin to reduce the temperature of the body, and the internal combustion is required to furnish only enough heat to replace that lost by radiation and convection. It will be observed that when a person suffers from a fever, the sweat glands are closed, and the skin rough and dry.

In addition to the functions of the skin already enumerated the skin possesses also a respiratory function, giving off a small amount of carbon dioxide and taking in a small quantity of oxygen. In this respect the skin performs to a slight extent the function of the lungs. The skin can also absorb slight amounts of water and other fluids, but these last named functions are of no great importance from the bathing standpoint.

Benefits of Bathing Bathing is beneficial to a person in a number of ways and affects, more or less, all of the glands, vessels, fibers and cells of which the skin is composed. These, in turn, react upon the large and more important organs of the body, thereby toning up the entire system. As has already been mentioned, dead scales, or cells, are constantly being shed from the outer surface of the scarf-skin. Some of these scales, however, are not cast off at once, but cling to the younger cells beneath or hang in ragged fragments to the body until removed by friction or other mechanical means. These scales are dead organic matter and unless removed will putrefy on the person, besides, in many cases, interfering with or obstructing the oil ducts and sweat pores. The putrefactive bacteria engaged in breaking down the skin scales might contain, among their number, some harmful kinds which would cause illness or death if introduced to the body through a puncture of the skin. It will be readily seen, therefore, that a bath of any kind, taken regularly, will remove this skin as fast as it is shed, thereby preventing the mouths of oil ducts and sweat glands becoming clogged by cast-off materials; will soften and remove the dead or dying skin which clings to the younger cells beneath, and will keep the skin physically, if not surgically, clean, thereby minimizing the danger from infection through a cut or bruise.

The beneficial influence of water not only upon the skin but likewise upon the nervous and circulating systems, as well as the internal organs of the bather, is due principally, to the temperatures of the water in which the bath is taken. Baths must, therefore, be considered according to their temperatures and modes of application, and the effect of hot and cold baths as well as vapor and hot-air baths will next be explained.

Cold-water Baths Generally speaking, it may be said that the effect of a cold bath is to close the pores of the skin, contract the capillaries, driving the blood from the surface of the body to the interior, leaving the skin white and bloodless. The functions of the skin being thereby temporarily arrested, the temperature of the blood rises from 2° to 4° Fahrenheit, which is equivalent to fever heat. Immediately after the bath, provided it has not been prolonged to an unreasonable extent, a reaction sets in, the sweat pores of the skin open, the capillaries expand and the overheated blood rushes back to the surface, bringing with it a healthy glow and a grateful feeling of warmth. So long as the healthy reaction can be induced, cold baths are beneficial to an individual, but if the skin remains white or turns blue the shock is too great and a warmer bath should be resorted to.

Baths in water from 65° to 55° Fahrenheit are considered cold, and anything below 55° Fahrenheit is considered very cold. Very cold baths cannot be borne long without ill effect, and baths which lower the temperature of the skin to 9° Fahrenheit may be endured for a very short time, but any further reduction of the temperature is liable to prove fatal. Baths in water from 80° to 65° Fahrenheit are considered cool baths.

When immersed in a bath of cold water the temperature of which is above 50° Fahrenheit there is a diminution of the temperature of the skin and tissues near the surface of the body and the temperature of the blood rises about 4° Fahrenheit. At the same time there is a slight shock experienced from the water, and if the cold is intense it induces a feeling of numbness in the skin, which becomes pale, due to contraction of the capillaries, which sends the blood to the internal organs.

As would be expected the cold bath likewise

affects the central nervous system and the heart and lungs, as may be seen by the tremor of the limbs, the gasping for air, and the general depression which follows, due to the pulse beat becoming weaker. After the bath reaction sets in bringing blood and warmth to the surface of the body. The colder the water and more powerful the depressing effect the quicker and more active will be the reaction, provided the individual is strong enough to withstand the shock.

Tepid Baths Any bath taken at a temperature between 80° and 92° Fahrenheit is a tepid bath. The effects of the tepid bath are not so numerous nor so far reaching as those of other temperatures, so that tepid baths can be borne for hours without ill results.

Spray treatment by overhead shower heads. Any temperature, any force, and various combinations can be rapidly alternated.

The effects of the tepid bath are confined to the surface and do not reach the internal organs or nervous and circulating systems. There is no reaction whatever following the tepid bath, and the body and blood temperatures remain unchanged. On account of the absence of shock or stimulus of the internal organs tepid baths are best for people of weak constitutions or weak hearts. They are the least beneficial of all the baths, however, for those of strong, robust constitutions, as their beneficial influence is confined simply to cleansing the skin.

Warm Baths Temperatures from 92° to 98° Fahrenheit include those of the warm bath. There is no difference in effect between a warm bath and a hot bath; the only difference is in the degree of action and reaction excited. In the warm bath the effect is not confined to the surface, but is propagated to the internal organs, which causes an increased flow of blood to the surface and an increased frequency of the pulse beat. It seems likewise to stimulate slightly the building up or renewal of new tissue.

Hot Baths A bath at any temperature between 98° and 104° Fahrenheit is a hot bath. When a person is immersed in a hot bath a transfer of heat takes place from the warmer to the cooler medium—that is, from the hot water to the bather—while at the same time the evaporation becomes checked, and the combined effort of the transfer of heat and checking of evaporation increases the body temperature of the bather.

In the effort to keep down the body temperature the capillaries expand and blood rushes to the surface of the body, the skin becomes congested and the accumulated body heat finally bursts forth, causing a profuse perspiration, while at the same time the pulse beat increases and respiration becomes quickened. It will thus be seen that in a hot bath the nervous and circulating systems become affected, which in turn react upon the internal organs. After the bath reaction sets in, the capillaries contract, all excess blood leaves the surface and the air at ordinary temperature feels cold to the skin.

Comparison of Hot and Cold Baths In comparing the effects of hot and cold baths upon normal individuals it might be stated as a general rule that the effects are opposite to each other; cold baths, on the one hand, tend to check perspiration, while hot baths favor it. It is believed, but not conclusively proven, that cold baths, by stimulating the internal organs, increase the reaction of the gastric and other fluids of the stomach and alimentary canal, while hot baths, on the other hand, tend rather to retard such activity. All baths, whether hot or cold, but particularly the latter, favor the secretion of urine.

Hot baths cause dilation of the capillaries and a rush of blood to the skin. When the stimulus of heat is withdrawn the capillaries contract

and all excess blood flows away from the skin.

The cold bath, on the contrary, first contracts the capillaries and forces the blood to the interior, then when the reaction sets in the overheated blood flows back to the skin through the dilated capillaries.

A warm bath raises the temperature of the body by transferring heat to it and at the same time preventing evaporation and radiation of heat from the body. The cold bath reduces the temperature of the surface of the body by withdrawing heat from it but raises the temperature of the blood.

The hot bath draws the blood to the surface while the cold bath drives it to the interior. In either case there is increased oxidation, or waste of tissue, but with the warm bath there is less demand made upon the system, because oxidation depends chiefly upon increased heat, which in this case is supplied by the water. The reason that a hot bath seems refreshing to an exhausted person when he could not take a cold one may be that the heat supplied by the water helps the process of oxidation without any tax on the system.

The hot bath can be borne longer than a cold bath and a tepid bath can be borne longer than either.

Vapor Baths So far the effects of water baths only have been considered, no mention having been made of vapor or hot-air baths. It should be borne in mind, however, that the body bears changes of temperature of air, or even of vapor, much better than it does of water, because water being a better conductor of heat than either air or vapor brings more heat to the body or carries off a greater amount, as the case may be, than would air or vapor of equal temperature.

The vapor bath, on account of the less specific heat, does not act as quickly as water on the body, but once the action does begin it causes a profuse perspiration and acts powerfully in cleansing the skin. Vapor baths can be borne hotter than water baths, but not for so long, for the vapor being of higher temperature than the bather, and being charged with moisture, not only prevents evaporation from the skin but likewise radiation from the body. In consequence of this the temperature of the vapor bath, while far less than that of the hot-air bath, heats the blood considerably more, besides impeding the respiration by depositing moisture in the bronchial tubes. A vapor bath can be borne for a much longer time when the vapor is not inhaled. Ordinarily, however, when the vapor is inhaled a temperature of more than 125° Fahrenheit cannot be borne with comfort.

The effect of the vapor bath is much the same as that of the hot bath, with the one exception, perhaps, that it causes a more profuse perspiration, and in that one difference lies the greater value of the vapor bath. The vapor bath is the chief feature of the Russian bath, while hot-air or radiant heat is the distinguishing feature of the Turkish bath.

Hot-air Baths Hot-air baths possess all the advantages of the hot-water bath, and some other advantages that hot-water baths, as well as other forms of bathing, do not possess. It is those latter qualities which give the hot-air or Turkish bath its hygienic value.

Soothing patients by means of flowing water in the bath tub. The most violent cases are generally soothed to sleep in a short time by this simple means.

One feature of the hot-air bath lies in the air which is inhaled. Unlike the air of a vapor bath it is not charged with vapor, so that moisture cannot be deposited in the bronchial tubes. Indeed, on account of the dryness of the air it increases instead of retards the evaporation from the lungs, while, being of a higher temperature than the body, there is no tax on the system heating the inspired air.

The greater benefit of the hot-air bath, no

doubt, is due to the profuse perspiration it induces without raising the temperature of the body over several degrees Fahrenheit. This profuse perspiration is beneficial in several ways. By exciting the glands it keeps them in a healthy and active condition; the fluids they pour forth flush the millions of little sweat ducts so that they will be perfectly clean, and last but not least, the fluid poured forth in the form of perspiration carries in solution waste products of the cell activity so that the blood is purified by the process.

It is in its function as a blood purifier, then, that the hot-air or Turkish bath differs most from ordinary baths, and it is in this function, that the chief value lies, for any other from of bath will clean the person, stimulate the organs and excite the circulating systems.

Routine of the Turkish Bath The Turkish bath, as now practiced, consists first of exposure of the naked body to dry, hot-air or radiant heat until a profuse perspiration has been induced; next massage followed by a thorough scrubbing, with brush, soap and hot water; then a cooling shower to close the pores, which may or may not be followed by a cold plunge. The last stage consists of drying the body and resting.

Of the various operations undergone by a bather the exposure in the hot room is the most important and the massage is of the least benefit. When properly performed, massage is of real benefit to a person, but slapping of the body with open palms to make a loud noise as commonly practised in Turkish bath houses, is of little or no value.

In its simplicity, then, the Turkish bath consists of exposure in the hot room, followed by kneading, rubbing, massage and a thorough washing, and this simple operation can be performed in the house as fully and with every bit as much benefit as in a public Turkish bath house, provided in addition to the ordinary bath room, there is a hot room or cabinet in which to induce perspiration. In the public bath room, however, numerous rooms and accessories are necessary in order to accommodate a number of patrons at one time and make the operation of bathing a luxury as well as a benefit.

Routine of the Russian Bath The Russian bath, as now practised, differs but slightly from that of the Turkish bath, the chief difference being in the use of a vapor room instead of the hot-air room used in the Turkish bath. After exposure in the vapor room until a perspiration has been induced the bather is put through the operations of kneading, rubbing, massage, scrubbing, shower, plunge, drying and rest as in the former case.

In most Turkish bath establishments a vapor room is provided in addition to the hot-air rooms, so that patrons may take either a Turkish or a Russian bath, or combine the two.

Vapor and hot-air baths are so beneficial to a person that it is to be regretted that provision is not more frequently made for them in the public schools, where they would be available for the public, either free or for a very small fee. The matter would be simple to effect, for a small room could easily be provided and fitted with means for heating and ventilating, so that the citizens as well as the children, could have both the benefit and the luxury of a Turkish Bath.

Effect Produced by Water Treatment In the treatment of the ailing with water, different effects are produced according to the temperature of the water used and the method of application. Insane people, when violent, and highly nervous people, when irritated or unstrung, are soothed and soon put to sleep by placing them in specially fitted bath tubs through which water is allowed to flow continuously.

Other effects are produced by spraying the patient from Sprinkle Heads arranged over the operating tub, while elaborate hydrotheropatic cabinets are made for applying the water to a patient gently or with force, at any desired temperature or alternating suddenly from one extreme to another, such, for instance, as from hot and mild to cold and with force.

Effect of temperature when bathing Children are often confused by the caution not to go bathing when feeling warm, and the apparently conflicting practice of following a hot bath immediately with a shower or play of cold water. The difference, however, is in the condition of the blood. When the body and blood are overheated, as for instance, walking a long distance in the sun, on a hot day, to the old swimming hole, the child should cool down to about normal temperature before venturing in the water. Nature is trying to drive the heat out of the body as fast as generated, while a cold plunge checks the effort of nature and turns it back on itself by closing the pores and driving the blood from the skin to the already overheated internal organs. After a hot shower on the other hand, the heat of the body is only surface heat. The hot shower has not heated the blood so that the effect on the internal organs is due to the reaction taking place in the skin.

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HYGIENE OF THE BATH

Use of soap in bathing

A distinction must be made between bathing and washing. The devotee of the morning dip or the daily bath takes it, not because he is so dirty that he needs a scrubbing, but for the tonic effect, and to remove the scarf skin and impurities by friction and washing. The daily use of soap, however, is not necessary, indeed is objectionable, particularly if it contains free alkali, as it is liable to cut the natural oil on the surface of the body intended to lubricate the skin, and have in general, the same effect as frequent washings with strong soap would have on the hair of the head.

Frequent bathing, then, should be sparing of soap.

Indeed, the Japanese—and no race has a better skin, take them as a whole—owe it perhaps as much to not using soap as to their practice of bathing daily. Instead of soap they use a bag of rice bran, or at least most of them do now, and all of them did formerly; but the Japanese who are in touch with foreigners are now beginning to adopt the soap habit to a greater or less extent, a practice which might prove ruinous to their velvety skins if they use it daily.

THE DOUCHE BATH

From this control cabinet the operator can apply the water to a bather in any desired way. As a spray or in a solid stream; hot, cold or intermediate, or any combination of these extremes.

Soap, of course, has its use. When the bath is for purposes of cleanliness, soap may be freely used. The morning dip, or cold bath, however, is for tonic effect, not for cleanliness only to a slight extent; and for a tonic bath no soap is needed. Instead, a stiff bristle brush or a bag of rice bran will prove not only more comfortable, but of lasting benefit. Friction of the brush or rice bag will modify the shock of the cold water, and at the same time remove from the body the dead skin—scales hanging thereto.

The Romans, when bathing was at its height in Rome, used to complete the bath by annointing their bodies with oil, sometimes scented oils or oils and perfumes. Olive oil and almond oil, also it is believed cocoanut oil, were used for this purpose; and the practice when properly followed is no doubt a beneficial one. However, before the practice becomes general and is followed in our vigorous and excessive American way, it would be advisable to find out first which of the vegetable oils are the best, and how frequently and in what amounts their use is beneficial. Injury, and even death, might follow the use of unsuitable or impure oils or ointments, as oils are absorbed through the skin, and in this way find their entrance to the blood. For the present, therefore, it is just as well not to encourage the use of oils after bathing.

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